10. ENVIRONMENTAL PROTECTION

The components of the Mixed Oxide (MOX) Fuel Fabrication Facility (MFFF) Environmental Protection Program include the following:

- The Radiation Safety Program, which is established to control and assess the level of radioactive releases to the environment during normal and anticipated off-normal operations, minimize facility contamination, and minimize waste generation
- The Effluent Monitoring Program, which is established to measure and monitor the radioactive effluents released from the facility
- The Environmental Monitoring Program, which is established to monitor potential environmental impacts from operations.

10.1 RADIATION SAFETY PROGRAM

The Radiation Safety Program is described in Chapter 9. That portion of the Radiation Safety Program related to protection of the environment is given herein.

10.1.1 ALARA Goals for Effluent Control

Effluent control begins with the facility design by limiting the material capable of becoming a radioactive effluent. The MFFF processes generate minimal airborne radioactive effluents, and no radioactive liquid effluents are released directly to the environment.

The as-low-as-reasonably-achievable (ALARA) goal for airborne radioactive effluents released from the MFFF is 20% of the effluent concentrations from 10 CFR Part 20, Appendix B, Table 2, Column 1. Additionally, the goal for total effective dose equivalent to the individual member of the public likely to receive the highest dose from the facility, based on estimates for normal operations, is less than 10 mrem/yr. Normal operating release values are calculated at the restricted area boundary (RAB). The dispersion model calculates the X/Q for the 50 % annual average for a receptor at the closest point to the stack (170.6 ft [52 m]). The X/Q value is 2.5E-4 sec/m^3. The maximum dose contribution is from Pu-239 and the concentration is 7.25E-16 Ci/ml, which is less than the ALARA goal and the constraint on air emissions of 10 CFR §20.1101(d). Procedures will be established to report exceedances of the constraint level in accordance with 10 CFR §20.2203 and to take prompt corrective action to prevent recurrence.

An ALARA goal for radioactive liquid effluents is not provided since the facility design precludes the release of radioactive liquid effluents to the environment.

10.1.2 Effluent Controls to Maintain Public Doses ALARA

As previously indicated, the MFFF does not discharge any radioactive liquid directly to the environment. The only nonradioactive liquid effluent is from storm drains. The sanitary drains are not in radiation areas.

Radioactive airborne effluents from the MOX processing (MP) and aqueous polishing (AP) process areas are filtered and released through the stack located on the roof of the MOX Fuel

Fabrication Building. Design features that support reduced airborne effluent releases to maintain public doses ALARA include the placement and use of filter banks containing a minimum of two stages of high-efficiency particulate air (HEPA) filters. These filters minimize environmental releases by removing particulates present in ventilation exhaust. Spaces with the greatest potential for generating airborne contaminants in the effluent (i.e., gloveboxes) are exhausted through these filters prior to discharge to the environment. Design features of the AP ventilation system also take into account potentially corrosive materials.

Specific decontamination factors have not been established for all filters but are expected to be more than adequate to reduce the total radioactivity to acceptable levels. The experience at the MELOX and La Hague facilities is that the concentrations of airborne effluents are less than the minimum detectability of continuous air monitors (CAMs) and samples evaluated in the laboratory.

The combined MP and AP airborne effluents are monitored with two monitoring systems, including two CAMs and two fixed air samplers, with each unit provided air representative of that present in the stack. A representative sample of the particulate effluent from the stack is collected continuously for determination of quantities and average concentrations of radionuclides released. The sampling is conducted regardless of the concentration of radioactive material in the effluent, which is expected to be negligible under normal operating conditions.

Trending of results from effluent monitors, samplers, and other MFFF airborne monitoring equipment provides early indications of elevated radiation environments. Procedures will be developed to identify evaluations and actions to be taken when the concentrations of airborne radioactivity exceed prescribed limits.

To investigate elevated stack releases and/or anomalies, sample connections are installed at key locations in the MP and AP process area ventilation ducts. The placement and use of sample connections are based on the risk to facility workers, site personnel, and members of the public. The potential for leakage from process systems, equipment, and confinements is also considered. The evaluation focuses on the equipment and spaces with the higher potential for leakage or airborne contaminants (e.g., AP process cells, and AP and MP gloveboxes) as determined by experience at the MELOX and La Hague facilities. During MFFF operations, elevated readings from CAMs and/or fixed air samplers will be used to identify the need to perform maintenance or to take other action to reduce effluent releases. Following a loss of offsite power, the CAMs and fixed air samplers obtain power from the uninterruptible power supply (UPS) and emergency diesel power sources.

10.1.3 ALARA Reviews

ALARA reviews and reports to management include the development of trending charts so that analytical results and effluent monitor readings can be trended against the goals. Abnormal increases in the trending of either the monitor readings or the analytical results are reported to MFFF management as soon as practical. To ensure that releases are maintained ALARA, management is informed of the trends measured against the goals on a quarterly basis. Annually, the goals are reevaluated and new goals are established for the upcoming year.

10.1.4 Waste Minimization and Waste Management

The Waste Minimization Program begins with the process design and continues into operations. During the process design, recycling and reuse are implemented for waste minimization purposes. For operations, waste minimization procedures will provide for separation and segregation of solid and liquid wastes and the removal of packing and shipping materials prior to entry into contaminated areas. Worker training will also be developed.

Many of the design features addressed in the MP and AP process descriptions (Sections 11.2 and 11.3, respectively) perform contamination control and associated waste minimization functions. In addition to the confinement system, the process design reduces the distribution and retention of radioactive materials throughout plant systems by using vacuum systems in the gloveboxes. Airborne dust is collected in dust pots in dedusting systems installed in selected gloveboxes, and the material is recycled. These design features control contamination to ensure that secondary waste production is minimized during plant operation and to ensure that only a minimal amount of contamination is generated. The design incorporates extensive recycling for the materials exiting the main process (e.g., secondary waste streams of the AP process and scraps not meeting specifications in the MP process). The recycling process is designed to minimize the quantity of plutonium in the final waste by using systems that return the radioactive materials to previous steps of the main process.

The following features of the AP process are specifically designed to minimize waste by maximizing recycling or recovery:

- **Acid recovery** – Nitric acid is recovered from the bottom of the rectification column and reused as reagent feedstock in the aqueous polishing units. The distillates from the rectification column are also collected and redistributed to the aqueous polishing process.
- **Solvent regeneration** – Following purification of the plutonium solution in pulsed columns by solvent extraction, the extracted raffinate stream is washed with diluent and routed to the Acid Recovery Unit. The regenerated solvent is adjusted with the addition of pure tributyl phosphate and reused in the Purification Cycle.

The design includes systems that provide separation and segregation of streams to minimize the amounts and types of contaminated materials. There are separate collection tanks for laboratory rinse waters and sanitary washings. There are also features to concentrate streams through evaporation. The acid recovery evaporator produces distillates that are relatively free of radioactivity and can be reintroduced into the process, while its concentrates contain wastes that are prepared for disposal.

MFFF waste management is guided by the principles of ALARA, waste minimization, and pollution prevention. Liquid and solid wastes produced in the MFFF will be transferred to the Savannah River Site (SRS) for processing and disposal. DCS has worked closely with SRS during the MFFF design phase and has provided SRS with waste characterization information. SRS has reviewed and evaluated the information in the context of the existing Waste Acceptance Criteria (WACs). DCS is committed to meeting the SRS WAC or providing a stream that qualifies for a WAC Deviation and Exemption. The MFFF low-level waste streams meet the SRS WAC except for the chloride stream. Based on evaluation of the characterization information by SRS, the chloride concentration is sufficiently close to the WAC that a WAC Deviation and Exemption for the SRS Effluent Treatment Facility (ETF) will be issued. The WAC for the SRS Waste Solidification Building (WSB) has not been prepared, but the interface between DCS and SRS will ensure that the WSB is designed to manage the MFFF high alpha waste stream and the depleted uranium stream.

The expected and maximum waste volumes and concentrations of the main chemicals and radioisotopes have been computed for the liquid waste streams. The tanks, pumps and transfer lines have been designed on this basis as well as the planned waste transfer frequencies.

The various streams from the MP process are extensively treated to recover feedstock and plutonium to the maximum extent practical, resulting in a very small amount of generated waste that is transferred to SRS. The various waste streams and their disposition are discussed in the following sections.

10.1.4.1 Liquid Waste Management

The quantity of radioactive liquid waste is small because the AP process uses recycling to the extent feasible; all liquid wastes are transferred to SRS. Figure 10-1 depicts the streams from the AP process.

10.1.4.1.1 High-Alpha-Activity and Stripped Uranium Streams

Two liquid streams from the AP process are classified as high-alpha-activity streams: the americium stream and the alkaline wash stream. The excess acid stream, from acid recovery, is also managed as a high-alpha-activity stream because of the stream properties. These three streams are combined and the merged stream is managed as the high-alpha-activity stream. The stripped uranium stream contains less than 1% uranium 235 following isotopic dilution. The stream is managed at the SRS WSB.

The high-alpha-activity and stripped uranium streams are separately pumped to the SRS WSB in dedicated double-walled stainless steel pipes provided with leak detection. The leak detection system provides early warning of any leaks in lines used for transfer of radioactive liquid streams from the MFFF to the WSB so that remedial action may be initiated. The high alpha and stripped uranium liquid transfer lines are designed to withstand the effects of the design basis earthquake and other applicable events as described in Chapter 5.

The waste transfer lines are buried underground and are unlikely to be impacted by load handling activities. The waste transfer lines will be designed to accommodate external loads, including dead loads (soil pressure) and live loads (wheel loads).

Liquid Americium Stream

The raffinate from the Polishing Process contains americium, gallium and traces of plutonium extracted from the plutonium oxide feed and silver from the dissolution unit. This stream is termed the liquid americium stream and is a high-alpha-activity stream. The americium stream, along with the alkaline and excess acid streams, are transferred to the batch constitution tank where they are mixed, analyzed for pH, and then transferred to a high alpha storage tank. The

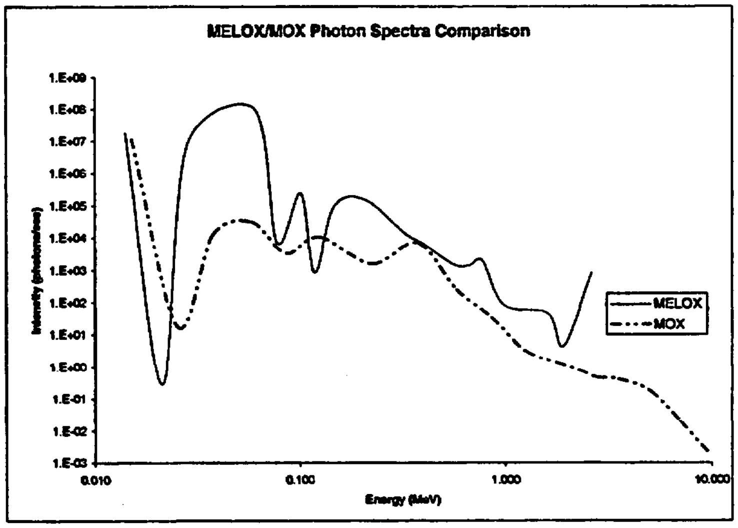

Figure 9-10. MELOX/MFFF Photon Spectra Comparison

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high alpha storage tank along with the high alpha buffer storage tank are a holding point for the high alpha streams and provide 90 days of storage. The contents of the high alpha buffer storage tank are sampled and analyzed to ensure compliance with the SRS WAC before being pumped to the WSB through dedicated double-walled stainless steel pipes provided with leak detection.

Excess Acid Stream

The acid recovery process produces a condensate stream and excess acid. The acid recovery condensate stream is transferred for AP recycled water solution feeding. The excess recycled water is collected in a buffer storage tank, analyzed for activity and transferred to the liquid waste reception unit. The recovered excess acid is expected to be a liquid high-alpha-activity stream and is managed with the high-alpha- activity stream. The excess recovered acid is transferred to a buffer tank and then to the batch constitution tank, where it is mixed with the other high alpha liquid streams and managed as described previously.

Alkaline Wash Stream

The alkaline treatment process generates an alkaline wash stream. After these washings, the alkaline wash stream is transferred to the alkaline waste tank. The alkaline wash stream is then transferred to the batch constitution tank where it is mixed with other high alpha liquid streams and managed as described previously.

Waste Solvent Stream

The alkaline treatment process generates a small quantity of slightly contaminated excess solvent. The slightly contaminated excess solvent is a low-level waste (LLW). Waste solvent is pumped from the solvent recovery tank to an intermediate holding tank where it is sampled to assure compliance with the SRS WAC. The intermediate tank is fitted with mixing and sampling capabilities. The batch is transferred through a dedicated pipe to a 300-gallon carboy or other suitable container located in an enclosure outside the Reagents Process Building.

The carboy transfer operations from MFFF to SRS will be controlled under the radiation protection program as described in Chapter 9. The waste container will be transferred to an SRS vehicle for transport from MFFF. HP technicians will accompany the movement of the vehicle from the loading area, to the Restricted Area boundary (RAB). SRS will take possession of the waste prior to reaching the RAB and is responsible for the safe movement and disposition of the waste.

Stripped Uranium Stream

After the uranium-stripping process, the highly enriched uranium undergoes isotopic dilution and is collected in the stripped uranium reception tank. The uranium stream also contains a small amount of plutonium. The uranium stream is sampled and analyzed to ensure that it complies with the WAC. The stripped uranium stream is transferred to the stripped uranium buffer tank for neutralization and acidification before transfer to the stripped uranium transfer tank. The stripped uranium transfer tank is the final holding and sample point for the stripped uranium stream. After verification that the stream complies with the SRS WAC, the stream is transferred to the SRS WSB through dedicated double walled construction piping provided with leak detection.

10.1.4.1.2 Chloride Stream

A dechlorination step is necessary for product quality before dissolution for chlorinated feeds (e.g., AFS). The extracted chlorine is filtered and washed in a scrubbing column. The chlorinated liquid stream is transferred from the dechlorination/dissolution unit to a reception tank in the Waste Reception area. The chloride stream is diluted using chloride free streams destined for the Effluent Treatment Facility (ETF). This dilution step will reduce the chloride concentration to a value acceptable to the ETF without increasing the total volume of waste being generated. The combined stream will be sampled and analyzed to verify compatibility with SRS site requirements and will be then pumped to the SRS ETF.

10.1.4.1.3 Potentially Contaminated Water

Potentially contaminated wastewater is collected in the MFFF. This wastewater consists of laboratory rinse water, mop water from washing, MFFF building floor drains, and condensate from room air conditioners. These waters are collected, sampled, and analyzed. After analysis, the water is transferred to the SRS ETF.

Potentially contaminated liquid containment features include the following engineered systems:

- Tanks containing contaminated liquids are located in containment basins.
- Stainless steel-lined floors and portions of walls creating containment basins are used in tank rooms of the AP building.
- Double-wall pipe and leak detection are used on transfer lines to SRS.

10.1.4.1.4 Nonhazardous Liquid Waste

Nonhazardous liquid waste includes rinse water and the sanitary waste from sinks, showers, urinals, and water closets. Nonhazardous wastewater, exclusive of the potentially radioactive LLW rinse water, will be discharged to the SRS sanitary sewer system.

10.1.4.2 Solid Waste Management

Solid waste is classified as solid transuranic (TRU) waste, solid mixed TRU waste, solid LLW, solid mixed LLW, hazardous solid waste, and nonhazardous solid waste. Wastes are processed through the waste storage unit prior to transfer to SRS. Solid wastes (with the exception of nonhazardous solid wastes) are transferred to SRS. These solid waste types are discussed in the following sections.

10.1.4.2.1 Solid Transuranic Waste

Solid TRU waste generation is related to the normal process operations, maintenance operations, and replacement of equipment.

Several types of waste originate from glovebox operations. These include cleaning materials, such as cotton, wool, and cellulose fabrics used for cleaning inside the gloveboxes; maintenance wastes, including parts and equipment removed from service; and removed gloves.

Convenience cans are a waste stream originating in the decanning glovebox. Molybdenum boats are a source of waste from the sintering of pellets. Zirconium clads and laboratory wastes (glass) are mainly generated by control operations on samples at each production batch. Balls from the ball mills and welding samples are other metallic wastes.

HEPA filters used in the gloveboxes are another source of waste. Decloggable filters will be used in the grinding gloveboxes, thus reducing the number of HEPA filters disposed and providing an opportunity to recover plutonium.

Plastic wastes include latex, neoprene, and polyurethane gloves, as well as polyvinyl chloride, polyethylene, or polyurethane. Other wastes include grinding wheels and ceramic wastes from maintenance and repair of the sintering furnaces, staff clothing, and other maintenance-related wastes.

Solid TRU waste streams are separated at the source of generation and packaged in standard waste containers. Waste drums are marked at the point of generation, uniquely labeled, and tracked through storage and shipping.

10.1.4.2.2 Solid Mixed Transuranic Waste

Mixed TRU waste contains both a hazardous component and a TRU radioactive component. Solid mixed TRU waste produced at the MFFF may include lead-lined gloves, if they are used in the gloveboxes. The gloves, if they are used, are considered mixed TRU waste because they meet the criterion for TRU waste and the criterion for the toxicity characteristic for lead. Mixed TRU waste is handled as discussed above for solid TRU waste.

10.1.4.2.3 Solid Low-Level Waste

LLW will be generated as a result of normal MFFF process operations and maintenance activities and includes alpha-emitting TRU radionuclides with half-lives greater than 20 years but in concentrations less than 100 nCi/g of the waste matrix without regard to source or form. LLW is expected from normal process operations and from routine and nonroutine maintenance activities. Solid LLW will include the following material: cleaning materials (e.g., cotton, wool, and cellulose fabrics used for cleaning gloveboxes), parts and equipment, plastic wastes, inner cans, room filters, uranium area waste, wipes, packaging foils, protective clothing, and maintenance-related wastes.

All waste that is potentially contaminated with plutonium is treated in the same fashion, with steel drums used as the standard waste containers. However, the waste category is not determined until the waste containers are counted and categorized by waste type. They are then separated and stored as TRU waste, mixed TRU waste, LLW, and mixed LLW.

10.1.4.2.4 Solid Mixed Low-Level Waste

Mixed LLW is LLW determined to contain both a hazardous component subject to the Resource Conservation and Recovery Act (RCRA) and source, special nuclear, or byproduct material. Mixed LLW includes hazardous materials contaminated with plutonium and scintillation vials from the analytical laboratory.

Mixed LLW is packaged and transferred to SRS in a manner consistent with the SRS requirements. To the extent practical, commingling of waste from streams requiring different treatment technologies will be prevented.

Containers of hazardous waste known or suspected to be contaminated with radioactive material are uniquely labeled and tracked through storage and shipping. The mixed LLW is then transferred to SRS.

10.1.4.2.5 Hazardous Solid Waste

Hazardous solid waste is waste that is, or contains, a listed hazardous waste or that exhibits one of the four U.S. Environmental Protection Agency (EPA) hazardous waste characteristics (i.e., ignitability, corrosivity, reactivity, and toxicity). Hazardous waste includes some wastes from the analytical laboratory that are not contaminated with radioactive material. MFFF hazardous waste is transferred to SRS.

10.1.4.2.6 Nonhazardous Solid Waste

Nonhazardous waste is waste that is not or does not contain listed hazardous waste, that does not exhibit one of the four EPA hazardous waste characteristics, and that does not contain radioactive material. Nonhazardous solid waste includes office trash and other industrial wastes from utility and maintenance operations. Nonhazardous solid waste is packaged in conformance with standard industrial practice. Recyclable solid wastes (e.g., office paper, metal cans, and plastic and glass bottles) are sent offsite for recycling. The remaining solid sanitary waste is sent to a solid waste landfill.

10.1.4.3 Laboratory Waste

The laboratory is treated separately because it is a discrete source of waste and may produce various types of radioactive and hazardous wastes. The laboratory receives samples from the MP process as powder and pellets and as vials of liquid intermediates from the AP process. Laboratory waste solutions containing plutonium are collected and recycled back to the AP process according to solution composition.

Chemical reagents contaminated with radioactivity may be solidified in the laboratory and disposed of as solid mixed LLW. Hazardous chemical waste is collected and packaged for transfer to SRS.

10.2 EFFLUENT MONITORING PROGRAM

10.2.1 Airborne Effluent Monitoring and Sampling

Airborne emissions from the MFFF are controlled by the building and glovebox ventilation systems, the process ventilation offgas system, and MFFF stack HEPA filters.

10.2.1.1 HEPA Filter Testing

HEPA final filter banks contain provisions for dioctyl phthalate (DOP) testing. Following maintenance on the final filter banks, such HEPA filters are DOP-tested prior to being placed in service.

10.2.1.2 Radionuclides in Airborne Effluents

Estimated annual airborne effluent releases from the MFFF stack are based on experience at the MELOX and La Hague facilities. Extensive experience at these facilities has shown that the concentrations of airborne effluents are less than the minimum detectability of CAMs and samples evaluated in the laboratory. Due to the content of incoming feedstock and MFFF processes, radioactive airborne releases contain isotopes of plutonium, uranium, americium, and other minor dose contributors. The maximum concentrations of radioactive airborne effluents, averaged over a calendar year, are expected to be much less than 20% of the values in 10 CFR Part 20, Appendix B, Table 2. These airborne effluent values are approximately 9 wt % uranium and 4 wt % plutonium. Almost all of the uranium generated by MP process area activities is expected to be ^{238}U.

10.2.1.3 Physical and Chemical Characteristics of Radionuclides

Duke Cogema Stone & Webster (DCS) will demonstrate compliance with the annual dose limit in 10 CFR §20.1301 as provided for in 10 CFR §20.1302(b). Therefore, DCS does not need to take into account the actual physical and chemical characteristics of the effluents (e.g., aerosol size distribution, solubility, density, radioactive decay equilibrium, and chemical form).

10.2.1.4 Discharge Locations and Monitoring

The MFFF stack represents the only facility location that has the potential for discharging airborne radionuclides. The various process exhausts are mixed and filtered through at least two HEPA filter stages before being released through the MFFF stack.

Two redundant CAMs and two fixed airborne particulate samplers monitor the MFFF stack. Gaseous grab samples are collected periodically during operation. Output from the CAMs alerts personnel in the Polishing Utilities Control Room (located in the Shipping and Receiving Building) and the Respirator Maintenance/Health Physics Office (located in the Technical Support Building), by way of audible and visual alarms, if the airborne radioactive effluent exceeds a prescribed limit.

Continuous sampling of the main stack effluent addresses the combined source of radioactive airborne contaminants from the MP and AP processes during normal and anticipated off-normal operations. To quantify the contribution from each source, two additional CAMs are included to sample the discharged air from the MP and AP process areas. Effluents from areas not used for processing special nuclear material (e.g., laboratories, storage areas, and fuel element assembly areas) are also sampled continuously.

Upstream or local area CAMs are also installed to identify elevated releases resulting from off-normal operations. Data collected from these monitors will support control room operators in locating the source of increases in airborne radioactivity. CAMs are installed to obtain the lowest minimum detectable concentration for monitoring airborne effluents.

Information concerning the following elements associated with airborne effluents will be submitted with the license application for possession and use of special nuclear material:

- A description of the sampling, collection, and analysis procedures, including the minimum detectable concentration of radionuclides, equipment, calibration information, and laboratory quality control procedures
- A description of the proposed action levels and actions to be taken when action levels are exceeded
- The identification of the pathway analysis methods to estimate public doses, including a demonstration of compliance with 10 CFR §20.1301, through a calculation of the total effective dose equivalent to the maximally exposed offsite individual
- A description of the recording and reporting procedures, including event notification for airborne releases.

10.2.2 Liquid Effluent Monitoring

Since there are no radioactive liquid effluents, liquid effluent monitoring is not necessary.

10.3 ENVIRONMENTAL MONITORING PROGRAM

The Environmental Monitoring Program assesses the environmental impact of licensed activities and will include preoperational and operational environmental monitoring.

The objectives of the Preoperational Environmental Monitoring Program are as follows:

- Establish a baseline of existing radiological and biological conditions in the area of the MFFF site
- Determine the presence of any contaminants that could be a safety concern for personnel
- Evaluate procedures, equipment, and techniques used in the collection and analysis of environmental data, and train personnel in their use.

The objective of the Operational Environmental Monitoring Program is to determine whether or not there are adverse impacts from operations that result in radiological and biological effects to the MFFF site and environs.

Radiological impacts to the environment from operation of the MFFF are expected to be minimal. Since the MFFF does not discharge any radioactive liquid directly to the environment, the Environmental Monitoring Program will focus on the environmental media impacted by the airborne pathway for the anticipated types and quantities of radionuclides released from the facility.

The Operational Environmental Monitoring Program is being developed with SRS and will be integrated with existing and future environmental monitoring programs, as appropriate. Pre-construction environmental monitoring measurements for the entire Plutonium Disposition Program at SRS have been recently completed and are contained in "Plutonium Disposition Program (PDP) Preconstruction Environmental Monitoring Report", dated June 26, 2002.

Details of the Environmental Monitoring Program will be submitted with the license application for possession and use of special nuclear material. At a minimum, the preoperational assessment will contain the following elements:

- A characterization of the existing environmental conditions that could be affected by the operations of the facility
- The establishment of background levels of radioactivity
- The characterization of pertinent environmental parameters
- The identification of potential pathways for human exposure and environmental impact.

The MFFF preoperational assessment will establish or confirm the applicability of an MFFF Operational Environmental Monitoring Program that determines radioactivity levels of environmental media (e.g., air, surface water, groundwater, soil, sediments, and vegetation), as appropriate, with analyses for uranium, plutonium, and other radionuclides of interest.

10.4 ENVIRONMENTAL PERMITS, LICENSES, AND APPROVALS

Tables 10-1 and 10-2 list the environmental permits and plans that are required prior to construction and prior to operation of the MFFF, respectively. The permits and plans that are required prior to MFFF construction activities are under preparation, and several discussions associated with permitting strategies with the South Carolina Department of Health and Environmental Control (SCDHEC) have taken place.

Several Site Utilization Permits are being prepared for the SRS Environmental Protection and Site Utilities Departments since approval of these permits is driven by procedures internal to SRS and is outside of the purview of SCDHEC.

10.5 DESIGN BASES

This section discusses the design bases requirements applicable to the design of the stack effluent monitoring system and the programs and systems in place to manage radioactive, mixed, hazardous, and non-hazardous wastes. The MFFF will be designed to provide appropriate waste management systems and to monitor releases.

The safety assessment of the design bases and concepts for principal structures, systems, and components (SSCs) are described in Chapter 5. The stack effluent monitoring system (including the CAMs and air samplers) and waste management systems, with the exception of the high alpha liquid transfer line, are not principal SSCs because they are not relied upon to prevent or mitigate design basis accidents.

10.5.1 Design Basis for Non-PSSCs

10.5.1.1 Effluent Monitoring

Redundant CAMs and air samplers, two each, are designed to provide indications and early warnings of radioactive effluents released to the environment. The airborne effluent CAMs (in conjunction with the air samplers, laboratory testing, and calculations) are capable of ensuring that the annual average concentrations of radioactive gaseous effluents do not exceed the concentrations presented in 10 CFR Part 20, Appendix B, Table 2, Column 1.

The effluent CAMs and air samplers (i.e., stack monitors) will be connected to a reliable source of normal power. In the event normal offsite power is lost, the CAMs and air samplers are powered from UPS units and emergency power.

Although they are not principal SSCs credited with prevention or mitigation of design basis events, the redundant CAMs and air samplers and their respective electrical and mechanical features will be separated to prevent common mode failures.

The stack effluent monitors and air samplers will provide information to comply with 10 CFR §70.59 (effluent monitoring reporting requirements). The stack effluent monitors and air samplers are designed in accordance with 10 CFR Part 20 and using the following documents as guidance:

- Regulatory Guide 3.12, *General Design Guide for Ventilation Systems of Plutonium Processing and Fuel Fabrication Plants*, August 1973
- Regulatory Guide 4.1, *Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants*
- Regulatory Guide 4.15, *Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment*
- Regulatory Guide 4.16, *Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants*, December 1985
- Regulatory Guide 4.20, *Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees Other than Power Reactors*
- Regulatory Guide 8.37, *ALARA Levels for Effluents from Materials Facilities*
- ANSI-N13.1-1999, *Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities*
- ANSI-N42.18-1980, *On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents*
- ANSI-N317-1980, *Performance Criteria for Instrumentation Used for In-Plant Plutonium Monitoring Instrumentation.*

The minimum detectability of stack effluent radioactivity concentration is expected to be less than 5% of the concentration limits listed in 10 CFR Part 20, Appendix B, Table 2, Column 1.

The MFFF does not discharge radioactive liquid directly to the environment. The nonradioactive liquid effluent is limited to storm drains.

10.5.1.2 Waste Management

Uranium-235 in the stripped uranium transfer tank is established by upstream units at not greater than 1% of the total uranium which ensures that the waste is inherently safe with respect to criticality. (See section 6.3.4 for a description of the uranium content and controls).

10 CFR Part 20 sets requirements for the identification of radionuclides and the quantification of the nuclides in all solid waste containers. The MFFF will be designed to quantify the activity in solid waste containers and to ensure that the waste shipments meet the receiving facility's waste acceptance criteria. In addition to 10 CFR Part 20, the following documents provide guidance for the design of waste and operational systems for fuel fabrication facilities:

- Regulatory Guide 3.7, *Monitoring of Combustible Gases and Vapors in Plutonium Processing and Fuel Fabrication Plants*
- Regulatory Guide 3.10, *Liquid Waste Treatment System Design Guide for Plutonium Processing and Fuel Fabrication Plants*
- Regulatory Guide 3.12, *General Design Guide for Ventilation Systems of Plutonium Processing and Fuel Fabrication Plants*, August 1973
- Regulatory Guide 4.16, *Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants*, December 1985
- Regulatory Guide 4.20, *Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees Other than Power Reactors*
- NRC Information Notice 94-23, *Guidance to Hazardous, Radioactive and Mixed Waste Generators on the Elements of a Waste Minimization Program*
- ANSI/ANS 16.1-1986, *Measurement of the Leachability of Solidified Low-Level Radioactive Wastes by a Short-Term Test Procedure*
- ANSI/ANS 40.35-1991, *Volume Reduction of Low Level Radioactive Waste*
- ANSI/ANS 40.37-1993, *Mobile Radioactive Waste Processing Systems*
- ANSI N13.10-1974, *Specification and Performance of Onsite Instrumentation for Continuously Monitoring Radioactivity in Effluent*
- ANSI N15.10-1987, *Unirradiated Plutonium Scrap - Classification*
- ANSI N15.22-1987, *Nuclear Materials - Plutonium-Bearing Solids - Calibration Techniques for Calorimetric Assay*

- ANSI N317-1980 (1991), *Performance Requirements for Instrumentation Used for Inplant Plutonium Monitoring*
- ASME B31.3, *Process Piping*
- ISO 11932:1996, *Activity Measurements of Solid Materials Considered for Recycling, Re-use or Disposal as Non-radioactive Waste*
- DOE/WIPP-069, *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Rev. 7, November 1999.

10 CFR §20.1406 requires waste minimization. Guidance for achieving waste minimization goals is provided in NRC Information Notice 94-23.

The primary function of the Waste Minimization Program is to reduce the quantity of waste generated and the associated hazard of the waste. The program is intended to reduce worker and public exposure to radiation and radioactive and hazardous materials. The program also reduces the requirements for waste management facilities, including storage, handling, and disposal and the associated analysis. Waste minimization is (1) a preemptive activity that utilizes the design to reduce the potential for creation of waste, and (2) an operations philosophy that minimizes the introduction of excess materials that can become contaminated. Fundamental design features (e.g., confinement systems) minimize contamination. The MFFF design also incorporates surface coatings (e.g., paint and stainless steel drip pans) to reduce the potential for contaminating surfaces. Liquid waste tanks are designed to accommodate the maximum expected volume of liquids to reduce the potential for overflow and further contamination. These design features minimize the production of wastes and their impact on the environment.

10.5.2 Design Basis for PSSCs

The high-alpha activity and stripped uranium streams are pumped to the SRS WSB. The waste transfer lines are PSSCs. They are double walled stainless steel pipes seismically designed with leak detection. They are buried underground and unlikely to be impacted by load handling activities. The waste transfer lines will not be routed through yard storage areas where load handling activities are likely to occur. Load handling activities are not expected to occur outside of designated storage areas. The waste transfer lines will be designed to accommodate external loads including dead loads (soil pressure) and live loads (wheel loads). The transfer lines are designed to withstand the effects of the design basis earthquake and other applicable events as described in Chapter 5.

- ASME B31.3, *Process Piping*

Tables

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Table 10-1. Environmental Permits and Plans Needed Prior to Construction

AIR QUALITY PROTECTION

- Bureau of Air Quality (BAQ) Construction Permit (MFFF stack, diesel fuel tanks, diesel generators, concrete batch plant)
- Construction Emissions Control Plan (CECP)

SURFACE WATER PROTECTION

- Construction National Pollutant Discharge Elimination System (NPDES) General Permit
- No Discharge NPDES Permit (Concrete Batch Plant)
- SCDHEC Sanitary Wastewater Construction Permit
- Notice of Intent (NOI) for stormwater pollution prevention
- Stormwater Pollution Prevention Plan (SWPPP)
- Grading Permits

GROUNDWATER PROTECTION

- Domestic Water Distribution Construction Permit *
- Backflow Preventer Test Form
- Underground Storage Tank (UST) Construction Permit

SITE UTILIZATION*

- Site Utilization Permit
- Site Clearance Permit
- Underground Piping Permit
- Work Clearance Permit
- Power Services Utilization Permit (PSUP): Parts A and B

* Permits that will be acquired from the appropriate SRS department and that do not involve federal, state, or local agencies.

Table 10-2. Environmental Permits and Plans Needed Prior to Operation

AIR QUALITY PROTECTION

- Title V Operating Permit

SURFACE WATER PROTECTION

- SCDHEC Sanitary Wastewater Operations Permit
- Industrial NPDES General Permit
- Spill Prevention Control and Countermeasures Plan

GROUNDWATER PROTECTION

- Domestic Water Distribution Operation Permit*
- UST Operating Permit
- RCRA Generator Notification Number

SITE UTILIZATION

- Power Services Utilization Permit (PSUP): Part C*

* Permits that will be acquired from the appropriate SRS department and that do not involve federal, state, or local agencies.

Figures

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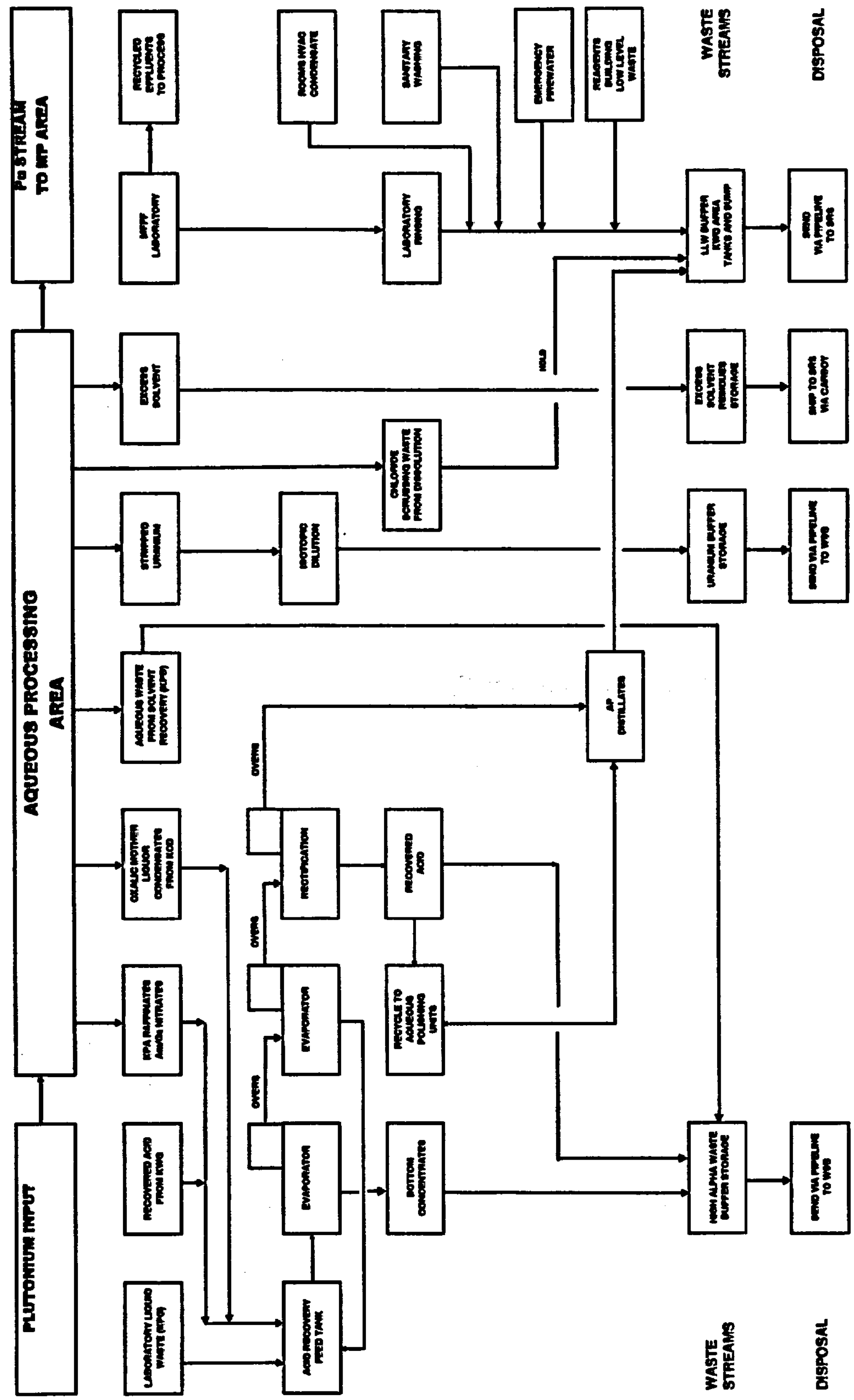

Figure 10-1. Aqueous Polishing Waste Streams

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